R20

II B. TECH I SEMESTER REGULAR EXAMINATIONS, FEB - 2022
MECHANICS OF SOLIDS
(MECHANICAL ENGINEERING)

Time: 3 Hours   **Max. Marks: 70**

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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UNIT-I

1. a) Derive the relation between Young's modulus, shear modulus [7M]
   and bulk modulus.

   b) Define the following [7M]
   a) Factor of safety   b) Poisson's ratio c) Hooks law.

(OR)

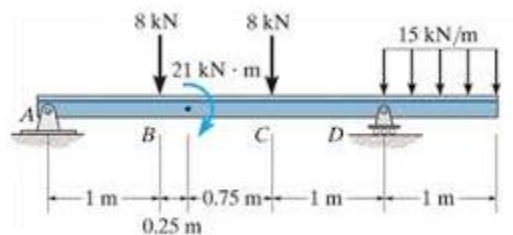2. a) Draw stress strain diagram for structural steel. Explain salient [7M]
   points on it.

   b) Explain various types of stresses with the help of diagrams. [7M]

UNIT-II

3. a) Draw the Shear force and bending moment diagram for the [7M]
   cantilever beam with UDL over entire span and point load at
   its free end.

   b) Draw the Shear force and bending moment diagram for the [7M]
   simply supported beam with UDL over entire span.

(OR)

4. Draw the Shear force and bending moment diagram for the [12M]
   loaded beam as shown in Fig.

UNIT-III

5. a) Derive flexure equation. [7M]

   b) A rectangular beam 200mm deep and 300mm wide is simply [7M]
   supported over a span of 8m. What uniformly distributed load
   per meter the beam may carry, if the bending stress is not to
   exceed $120 \, {}^{N}/_{mm^2}$.

(OR)

6. a) Derive the torsion equation. [6M]

b) A hollow shaft transmits 600kw at 500rpm. The maximum [8M] shear stress is 62.4MPa. find the outside and inside diameter of the shaft, if the outer diameter is twice of its inside diameter, assuming that the maximum torque is 20 percent greater than the mean torque.

UNIT-IV

7. a) A spherical shell of 2m diameter is subjected to an internal [7M] pressure of $2^N/_{mm^2}$. Find the thickness required for the shell, if the allowable stress is 100 $^N/_{mm^2}$. Also calculate change in volume. Take E=2x10⁵ $^N/_{mm^2}$ and Poisson's ratio=0.3.

b) Draw Mohr's circle for the following state of stress and [7M] calculate maximum and minimum normal stresses and maximum shear stress. Normal stress in X direction=100MPa

Normal stress in Y direction= -60MPa

(OR)

8. a) Differentiate between thin and thick cylindrical shells. [4M]

b) A thin cylindrical shell of 120cm diameter, 1.5cm thick and [10M] 6m long is subjected to internal fluid pressure of 2.5 $^N/_{mm^2}$. If the value of E=2x10⁵ $^N/_{mm^2}$ and Poisson's ratio=0.3, calculate change in diameter, length and volume.

UNIT-V

9. a) Calculate slope and deflection at the free end of a cantilever [7M] when it is subjected to uniformly distributed load over entire span.

b) Determine the safe load, that can be applied on a solid circular [7M] steel column, with both ends fixed. Its diameter is 15 cm and length 6m. Take Young's Modulus for the steel as 210 GPa and Factor of Safety as 3.

(OR)

10. a) Calculate slopes at both ends and deflection at the center of a [4M] simply supported beam when it is subjected to point load at its center.

b) Using Macaulay's method calculate slopes and deflections [10M] under the loads and also maximum deflection as the beam loaded as shown in figure.

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